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Chassis Lubrication of the Motor Truck and Motor Bus

THE automotive industry, in its application of the internal combustion engine to the solution of the problems of transportation, has created for itself a status of prestige unparalleled in the history of engineering progress.

The development of the motor bus and truck over the past few years is a typical example of the untiring devotion of the automotive engineer to an ideal wherein creative ingenuity coupled with research ability have been the paramount factors.

In the case of the passenger machine jitney transportation soon proved the fallacy of expecting economical results from a motor vehicle of average construction, due to the intensively heavy duty involved.

As a result the motor bus and its counterpart, the motor truck, have been developed as distinctive pieces of automotive equipment, in every detail designed and constructed to meet the most severe tests that research and engineering have been able to devise.

As a logical consequence bearing elements throughout have been built in proportion. For, to the credit of all concerned it has been realized that maximum reduction of friction by application of the principles of effective lubrication is the salient factor in the keeping of the average car on the road and out of the repair shop.

It may well be said that the majority of the troubles resulting from the developments of abnormal friction with consequent wear will occur on the chassis. In general, the power plant whether it comprise but a gasoline engine or a so-called gas-electric drive, will be provided with adequate means of protection for its bearing surfaces.

Efficient operation is thereby assured, provided lubricants are selected in accordance with the specifications developed by the engine or motor builders, and renewed or replaced as necessary according to practical experience in the operation of the bus itself.

Good motor oils do not wear out, but they do become contaminated by road dust, carbon accumulations and metallic particles which may have been worn from the working elements in the engine. Hence the necessity for their periodic renewal, unless provision is made for more or less purification or reconditioning during operation.

The average chassis part, however, cannot be so carefully protected. In its actual location it is subject to a far greater possibility of contact with contaminating foreign matter. The bulk of this will be road dust.

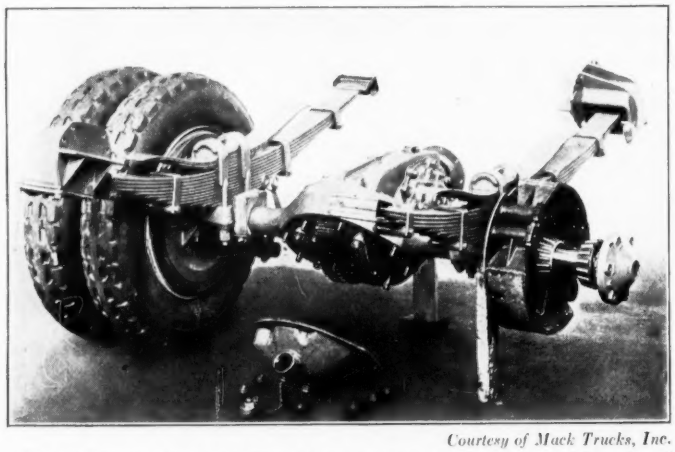
This latter probably involves the most serious condition to which lubrication of any such part may be subjected, for road dust being primarily of a silicious nature is highly abrasive. In consequence its presence within any bearing clearance space will not only tend to destroy the lubricating film but also it will be the direct cause of abnormal wearing of bearings and scoring of the surfaces of the moving elements.

PRINCIPLES INVOLVED

The principles involved in the lubrication of the average bus or truck chassis part, are essentially those of the grease or oil lubricated

bearing. The conditions of operation, however, may frequently be such as to give rise to decidedly trying problems from a lubricating point of view.

For example, the relative degree of motion between such parts as spring shackle bolts and



Courtesy of Mack Trucks, Inc.

Fig. 1—Exposed view of a differential and rear axle showing manner of fastening of gear case cover plate, and tapered axle bearings.

bearings will be comparatively slight. On the other hand unit pressures will normally be high, and temperatures of operation frequently so low (in cold weather) as to result in impaired lubrication due to congealing of the lubricating oil.

This latter furthermore, holds true whether oil or grease is used as the lubricant. For this reason, where grease is to be used, compounding with low pour test petroleum oils will be of decided advantage for they increase the factor of lubricating safety.

Grease lubrication of certain parts of the bus or truck chassis is more nearly a matter of pressure application of the lubricants to the wearing elements, for maintenance of an adequate lubricating film within the clearance spaces of spring shackles or brake connections, for example at all times can hardly be relied upon by virtue of the penetrative ability of the lubricant alone.

The principles of bearing lubrication as developed by intensive research indicate that the relative degree of motion must be comparatively high if oil is to be carried through the clearance spaces by the actual rotation of the moving element. This, of course, does not exist with many of the parts on the average bus or truck chassis.

PARTS REQUIRING LUBRICATION

The chassis comprises those essential parts on which the vehicle actually rides. These include spring shackle bolts, the steering mechanism, the universal joints, the wheel bearings, the brake connections, the propeller shaft bearings and the shock absorbers or air springs, for example.

It is fitting to discuss these more outstanding parts in detail from a viewpoint of their construction and methods of functioning in order that their lubricating requirements may be better understood.

Spring Shackle Connections

The essential points of the springs on the motor bus or truck which will require lubrication are the shackle pin or bolt bearings.

The purpose of springs is twofold: to improve the riding qualities and comfort of the machine, and to eliminate shocks as far as possible, for the latter would otherwise rack the body and cause more or less rapid deterioration.

Certain builders make use of a rubber pad or connection to eliminate the necessity for shackle connections and consequently lubrication at these points. The majority of buses or trucks, however, use the typical shackle pin or bolt connection to take care of the play

Courtesy of The Bassick Mfg. Co.

Fig. 2—Applying grease lubrication to spring shackle bolts using a hand compressor capable of developing 2,500 pounds pressure per square inch.

which occurs between the frame and spring members.

Spring connections by reason of the fact that they are frequently lubricated while carrying the weight of the body may not receive oil or grease throughout their bearing

surfaces. This is especially true where compression or screw-down grease cups are employed, involving hand regulation.

From a constructional point of view the average spring connection consists of a shackle pin or bolt contained in a one piece bearing.

To enable effective distribution of the lubricant and the maintenance of an adequate lubricating film between the pin and bearing, the former is drilled part way along its axis. From the inner end of this hole another is drilled at right angles thereto, to permit of passage of lubricant to the exterior surface. The lubricating fitting is installed in the outer end of the shackle pin or bolt, being screwed into the oil-hole which has been suitably tapped for this purpose.

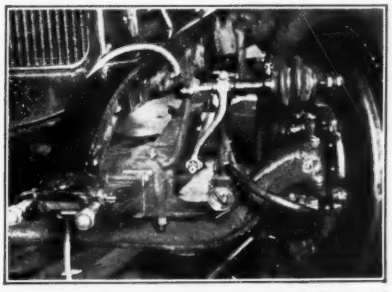
The Steering Mechanism

The average device of this nature will include knuckles, rods and the worm reduction gearing. Careful attention to the lubrication of rods and knuckles with the proper grade of oil or grease, according to the type of lubricating system, will make the machine steer far more easily, promote more comfortable riding, and render driving a far less tiring task to the operator.

Likewise the lubrication of the steering worm with the right grade of grease or gear lubricant will do away with that "stiff" movement of the wheel, reduce the occurrence of play and give far better control, enabling holes in the road to be dodged more easily without the possibility of wobbly front wheels.

Universal Joints

The object of a universal joint is to enable the transmission of motion from the engine and transmission to the rear end drive, with the least amount of lost motion or development of friction between the propeller shaft and its bearings.

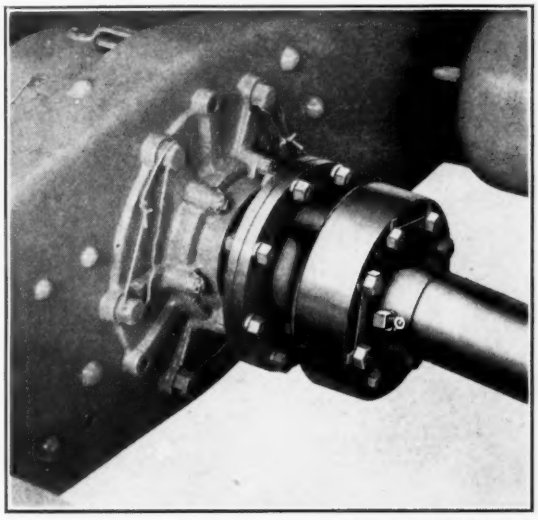


Courtesy of The Studebaker Corp.

Fig. 3—View of a front axle showing spring, brake and steering gear lubricating fittings for grease lubrication. It is important to observe care in not forcing too much grease into the brake control rod universal, otherwise it may work out onto brake shoes.

Universal joints must have as little play as possible for this will lead directly to loss of motion and power, cause jerky action in operation and impose undue pressure on transmission and differential gear teeth.

Such parts must, therefore, be carefully lubricated. Among the chassis parts the universal joints involve one of the several lubricating problems, due to the potential speeds which may be involved. The resultant centrifugal force tends to throw off the lubricant from the cross pin bearings, perhaps to involve loss or waste of the product, or at least the possibility of insufficient lubrication.



Courtesy of The White Co.

Fig. 4—Application of the Spicer Universal Joint to a motor bus showing oil plug and lubricating fitting.

On starting there is also the possibility of development of abnormal pressure; this may cause light greases to be forced out through the sealing cap or grease retainer.

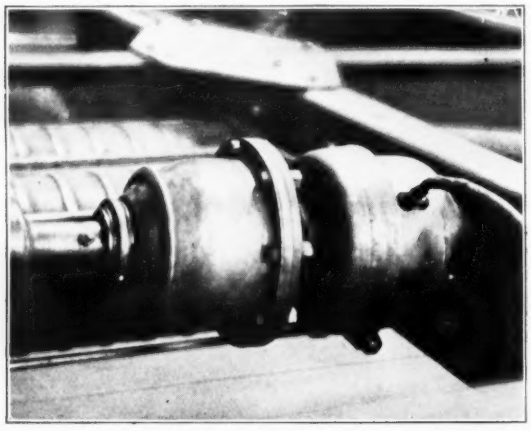
A soap thickened residual petroleum product has been found to meet these conditions in a satisfactory manner. Such a grease will be adhesive enough to resist centrifugal action, viscous enough to render leakage improbable, and yet capable of affording lubrication at all times.

Propeller Shaft or Steady Bearings

The purpose of such bearings is to carry the propeller shaft and maintain it in proper alignment. This shaft serves as the means of transmitting the power from the engine, via the clutch and transmission or speed change mechanism, to the rear axle and wheels. On account of the relative location of the former with respect to the rear end, and because of a certain amount of possible distortion, the propeller shaft is usually connected through suitable universal joints.

In view of the fact that considerable power losses may accrue should the propeller shaft fail to function properly, every care should be given to its bearings and especially to their

lubrication. These latter are essentially a part of the chassis and as such should be inspected and re-lubricated at each period of chassis lubrication whether this be carried out on a mileage or run basis.



Courtesy of American Car and Foundry Motors Co.

Fig. 5—For the lubrication of inaccessible midship bearings, a flexible tube can be led outward to a pressure gun fitting.

The motion involved is of a purely rotary nature. In other words, the principles of plain bearing lubrication may be said to prevail.

As a result the lubricant as recommended for the universal joints, for example, should insure continued and efficient service provided, of course, that the bearings are properly adjusted as to clearance, and maintained in a cleanly condition. This latter will be practically assured when lubricating with grease under adequate pressure to force any accumulated foreign matter through the clearance spaces and bearing grooves and out via the ends of the bearings.

Wheel Bearings

With both front and rear wheel axle bearings the operating conditions are to a certain extent akin to those of universal joints. In other words centrifugal force will tend to throw the lubricant away from the essential wearing points, to frequently result in abnormal wear. This will be indicated by wobbling and difficult steering of front wheels, by wear on differential gear teeth in the rear end and by undue wearing of both front and rear tire treads.

The prevalence of four wheel brakes also renders the matter of heat generated more of a problem than where it has only to be counteracted on rear wheel bearings.

Heat will be especially prevalent where braking is necessary to any extent. To meet this possibility as well as to effectively resist the action of centrifugal force, the same lubricant as designed for universal joints should be employed. This product, as mentioned above, by virtue of the high viscosity of its mineral oil content meets requirements very satisfactorily.

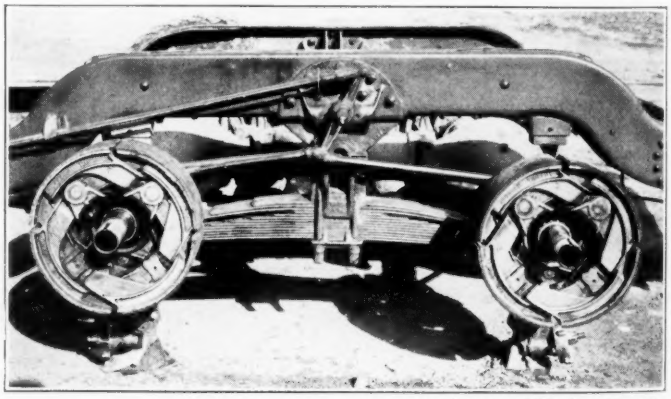
Furthermore, in cold weather, it has an admirable characteristic in that it does not solidify or congeal at low temperatures, and is, therefore, capable of performing its intended function, even though it may probably become somewhat more inert. As a general rule, filling of the hub caps will insure an adequate supply for several hundred miles of operation, although certain bus builders recommend filling daily at the time of general daily overhaul and chassis lubrication.

Brake Connections

Mechanical brake connections, such as hanger bearings, etc. involve perhaps more simple mechanisms than many other chassis parts. On the other hand they are among the most important operating parts on the average motor bus or truck.

The potential hazards that may accrue in the event of broken brake connections or brakes which do not function instantaneously or release promptly are so serious that every effort should be made to protect them effectively by proper lubrication.

In most cases brake connections are exposed to more or less dust and the effects of the weather. There will, therefore, be considerable likelihood of rusting and abnormal wear occurring if they are not kept supplied with adequate oil or grease, which has sufficient adhesive ability to "stay put" and not drip or throw off.



Courtesy of The Six-Wheel Co.

Fig. 6—View of rear wheel bearings of a motor bus designed for grease lubrication. Note that magazine oilers are cast in the trunnion bracket and Alemite fittings for grease lubrication are used on brake rigging.

Pressure lubrication is a most effective method of protecting brake cams and hanger

bearings and preventing the entry of water, dust and dirt. It is important to remember that premature wear of brake bands may be frequently caused by worn or corroded brake hanger bearings.

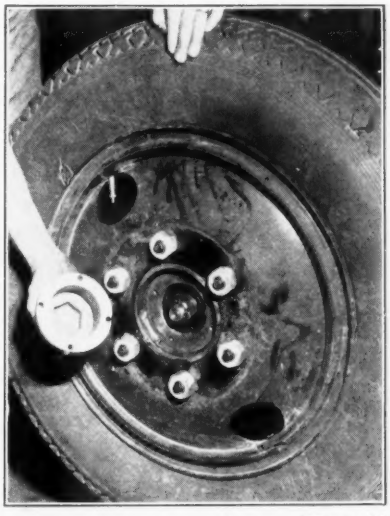
THE TRANSMISSION AND DIFFERENTIAL OR REAR END DRIVE

In the opinion of some, the above mechanisms whereby speed changes and development of actual motion are accomplished are not strictly chassis parts. Oftentimes, they are regarded as distinctly independent mechanisms. Perhaps this is by virtue of their construction and lubricating requirements, for, as a rule, they will not require as frequent inspection or renewal of their lubricants, nor will they function effectively on the same grades of the latter, as will the chassis parts discussed above.

As a result, it is deemed fitting to discuss them in this article and, for the purpose intended, to regard them as chassis parts.

Transmission and differential construction in the average bus or truck is much similar to the modern automobile. In the gas-electric bus the transmission is done away with; in fact, this is claimed to be one of the advantages of such a bus, over the mechanical or direct drive type of vehicle.

The necessity of transmission gears in the latter type, of course, requires their considera-



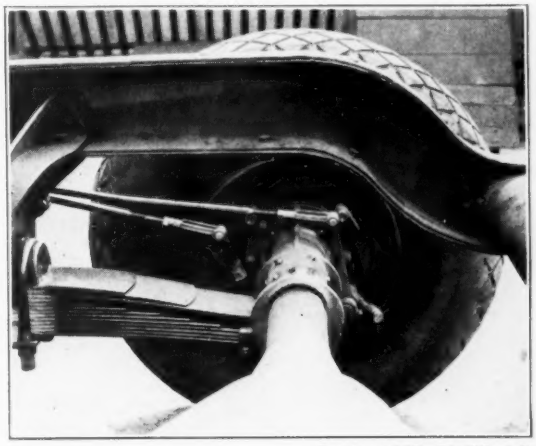
Courtesy of The Studebaker Corp.

Fig. 7—Exposed view of a front wheel bearing. To lubricate remove wheel, spread grease on rollers and in hub and partially fill the hub cap as shown.

tion, especially from a cold weather lubricating point of view.

Purpose Involved

Essentially such an installation involves a suitable train of gears to enable operation at variable speeds commensurate with the speed of the engine. They are of the selective type. In other words, the operator is able to use such gear ratios or speed reductions as may be necessary on account of traffic conditions, the roadway, etc., by the mere shifting of a lever.



Courtesy of The Six-Wheel Co.

Fig. 8—An application of the magazine wick-feed type of oiler to brake hinge pins on a six-wheel bus.

The differential or rear axle drive in turn, likewise involves an arrangement of gears. The differential is common to all types of such vehicles. Essentially this will involve worm or bevel gears according to the design of the drive. The object of the differential is a dual one, viz.:

(a) To transmit power from the engine, and electrical equipment where involved, to the rear axle; and

(b) To enable the rear wheels to rotate at different speeds, as is necessary when the bus or truck is turning corners or operating in any other than a straight line.

Prevailing Construction

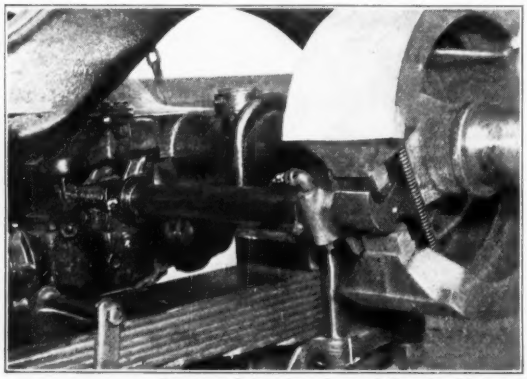
Both worm, and spur and bevel gear drives are used in the bus and truck industry today. Each is rugged, simple of design, relatively silent and capable of effectively meeting the usual heavy duty involved.

Whatever the type of drive, by virtue of its construction, the transmission and rear end in general will involve two distinct lubricating conditions. In a word, the lubrication of the gears, and worm where the rear end is worm driven, and the accessory shaft bearings.

Inasmuch as the one lubricant must, as a rule, serve both gears and bearings it must be of sufficient viscosity to not only maintain the requisite film of lubricant on the gear teeth but also to have adequate penetrative ability to serve the bearings whatever their type of design. Such a lubricant should always have as low a pour test as possible where it is to be used under low temperature conditions.

Type of Lubricant Required

Many so-called compounded gear lubricants, while admirably suited to warm weather conditions, are totally inadequate when temperatures drop below 40 or 50 degrees F. As a rule



Courtesy of American Car and Foundry Motors Co.

Fig. 9—An air-brake cam-shaft showing provision for pressure grease lubrication at three points.

they "set" or congeal to such an extent that the worm or gear will frequently cut a channel in the main body of the lubricant, thereby preventing it being carried to the teeth of the element above or distributed to the bearings.

In consequence, straight mineral lubricants will be best adapted to the gears of the average bus or truck.

In winter a viscosity of approximately 115 seconds Saybolt at 210 degrees F. should be used.

In warmer weather a viscosity of 200 seconds will be best. If refined from crudes of suitable base, especially to meet low temperature conditions, it is perfectly practicable to obtain such lubricants of as low a pour test as 15 to 20 degrees F.

In certain cases of both transmission and differential lubrication, however, it may be found best to thin down such lubricants to approximately the correct viscosity for cold weather service, by the addition of a low pour test oil. Especially is this advantageous where temperatures are below the pour test of the lighter product mentioned above. In such instances, reduction of viscosity by means of an oil of approximately zero pour test will oftentimes solve an impending problem very satisfactorily. The amount of oil necessary will depend, of course, upon the severity of the weather and the possible temperatures that may prevail.

In general, the addition of sufficient oil in an approximate ratio of two parts of gear lubricant to one part of oil will render the resultant lubricant in the gear case of the proper consistency.

When this lubricant is thoroughly mixed or blended in the transmission and rear axle (which occurs automatically when the gears rotate) there will normally be sufficient flow in cold weather to insure lubrication of all gears and bearings, and it will have the added advantage of reducing the power necessary for starting.

LUBRICATING EQUIPMENT

Having noted the more outstanding principles which are involved in chassis lubrication, and gained a working idea of the various parts, as brought out by the above discussion and certain of the accompanying illustrations, it is fitting now to study the several types of lubricators which are more or less adaptable to this service. These may be broadly classified under two general headings according to whether they involve the use of grease or oil.

Under the classification of grease lubricators would come:

(A)—Compression grease cups and
(B)—Pressure greasing devices.

Oiling systems would involve:

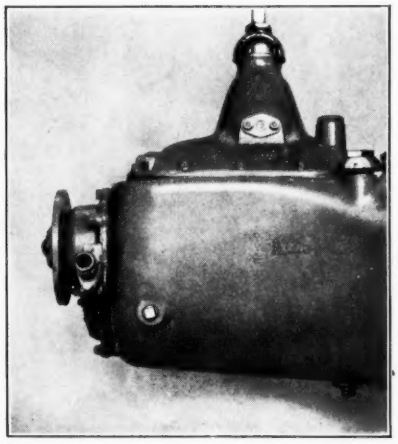
(A)—Oil Cups,
(B)—Wick oilers, and
(C)—Centralized oiling systems.

Grease Lubricators

Compression Grease Cups

The compression grease cup shares honors with the oil cup as being probably the oldest from the point of view of longevity of service as a means of chassis lubrication.

The former supplies grease to a bearing by virtue of a certain amount of pressure which is exerted upon the grease by means of the screw-



Courtesy of The White Co.

Fig. 10—Right side of a transmission case showing oil level, drain and filler plugs.

down cap. As a result, a thread of lubricant is continuously available for service regardless of the action of the moving element within the bearing as long as pressure is maintained and there is any grease in the cup.

While pressure is essentially the means of delivering grease to a bearing, the actual distribution within the clearance space may be aided by the motion of the moving element. Capillary action, heat and vibration all play a part in this regard.

Pressure Lubrication

Chassis lubrication by means of the compression grease cup has, however, largely given way to the so-called grease gun and fitting where grease is to be used as the lubricant.

The former will in general consist of some form of raised fitting or nipple equipped with a ball check valve to insure retention of the lubricant. By constructing the exterior of this fitting to conform with the design of the discharge nozzle of the pressure lubricator, it is practicable to render lubrication virtually automatic, and absolutely controllable upon attachment of the compressor or power lubricator.

Pressure lubrication of this nature is claimed to materially simplify and facilitate the matter of chassis lubrication in a cleanly and expedient manner. To attain a maximum of economy, however, it will be necessary for the garage personnel to have a clear understanding of the constructional details of the equipment involved and the capabilities of grease as a lubricant.

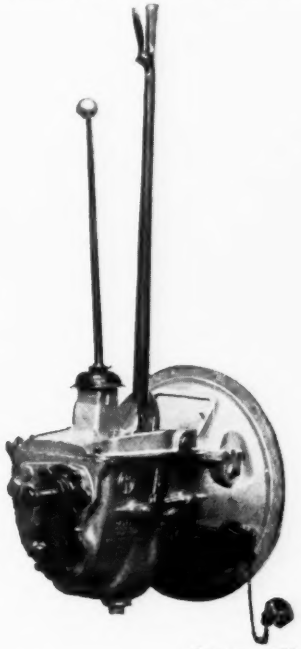
Oiling Systems

Oil Cups

In the development of the automotive industry the suitability of oil as a means of chassis lubrication has been a frequent point of contention among designing engineers.

In its original form it required the use of oil cups which had to be periodically filled by hand with an oil can. Essentially the oil cup as used for chassis lubrication is merely a reservoir, with no means of control of the oil feed.

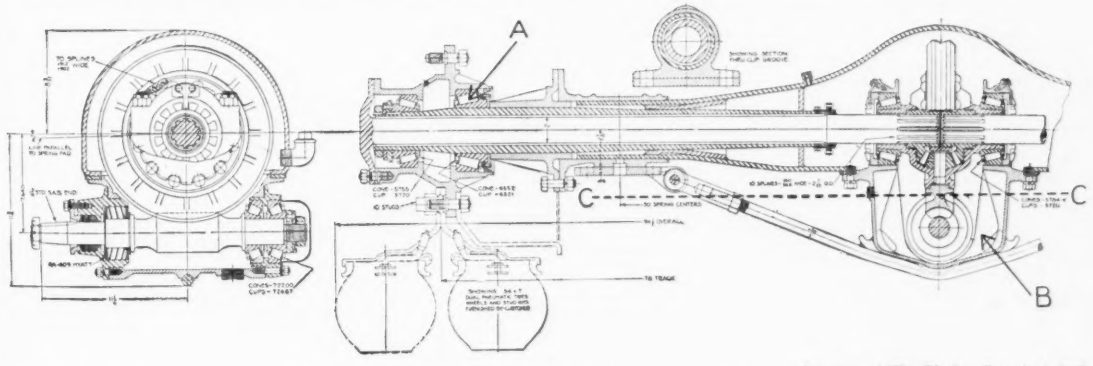
As a result, waste may be prevalent with an ever-present possibility of trouble on account of dust or dirt. For this reason the oil cup should be regarded as more or less unable to assure continued effective lubrication, especially on the chassis parts of the motor bus, however advantageous its low first cost may be.



Courtesy of Mack Trucks, Inc.

Fig. 12—View of a typical transmission showing oil level spout for gear case, and gear shift and brake levers.

The more practicable idea, if it is desired to use oil on certain of these parts, would be to study the adaptability of the wick feed or magazine type of oiler, or some form of manifold pressure lubricator.



Courtesy of The Timken-Detroit Axle Co.

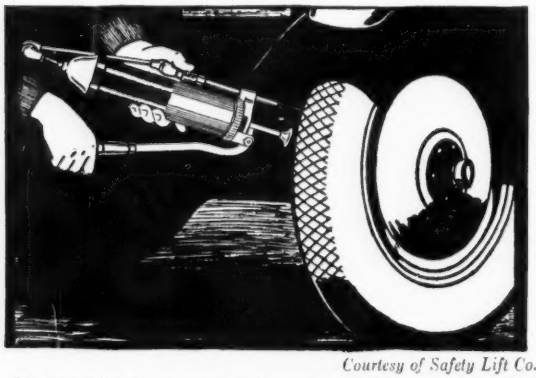
Fig. 11—Sectional view of an underslung worm drive rear axle showing details of construction and provisions for preventing leakage of lubricant. "A" indicates wheel bearings which require a heavy roller bearing grease of high melting point; "B" is the gear housing wherein a straight mineral low pour test gear lubricant should be used; and "C-C" indicates the proper level of this latter.

Wick Oilers

For the lubrication of spring shackle bolts, brake rocker shafts, fan bearings, steering pivots, clutch release bearings, etc., oil lubrication by means of the magazine oiler, for

example, is one of the proven methods of insuring such parts against wear, corrosion and the entry of dust. This device holds enough oil for about 5,000 miles of operation.

The essential principle of such lubricators is that of wick feed lubrication, oil being carried



Courtesy of Safety Lift Co.

Fig. 13—A hand gun, pump action, with a positive mechanical feed of the grease to the high pressure piston. Develops 10,000 pounds pressure when needed, to push through clogged fittings.

from a magazine or oil reservoir by virtue of the capillary action of a suitable wick.

In the so-called magazine oiler, one end of this wick is submerged in the oil reservoir; the other passing through an aperture in the attachment bolt of the lubricator, in sufficient length to permit of insertion within the drilled-out oiling passageway in the axis of the shackle bolt, for example.

Within the latter a similar passageway drilled radially downward at right angles to the axis connecting with the wick or oiling passage permits of oil delivery to the exterior surface of the bolt and the inner bearing surface of the spring shackle. This is the usual construction of the average shackle bolt, therefore, if the radial hole slopes downward no structural change or alteration of equipment is necessary, when a magazine wick oiler is to be substituted for any other type of individual lubricating device.

Steering pivots can, in turn, be also automatically lubricated, one magazine oiler being fastened to the upper boss feeding the upper and lower bushings and the thrust bearing. Brake rocker shafts, fan shafts, etc., can be likewise served.

The individual oil cup is also adaptable to service as a wick feed lubricator. However, whereas capillary action is involved in the magazine oiler, the wick feed oil cup requires both capillary attraction and the action of the siphon in the transmission of oil from the reservoir to the wearing parts.

Principles Involved

Capillary attraction alone is perhaps the more simple and economic, up-feed lubrication in general being absolutely automatic, starting and stopping according to the relative motion of the wearing parts. There is, therefore, no chance of wasted oil during any period of idleness or cessation of rubbing action between these parts.

Where a combination of capillary plus siphonic action is involved, in other words where oil feed is upward and then downward, in many cases oil will continue to pass through the wick just as long as there is any left in the reservoir. In industrial or marine types of wick oilers involving this principle of operation it is possible to remove the wicks during periods of idleness, thus insuring against oil wastage and sloppiness.

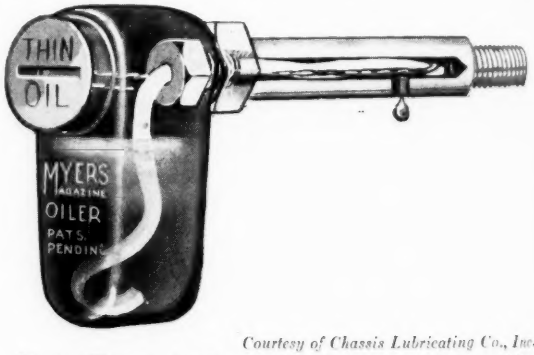
In automotive service, however, such a procedure would be relatively impracticable. Wick oilers involving siphonic action to any extent should, therefore, be carefully chosen for use on any automotive vehicle.

Low Pour Test Oils Essential

With any wick oiling system, however, it is well to remember that it will tend to become inoperative at such temperatures as may cause congealment of the oil. In cold weather, therefore, it is important to use oils which remain fluid at all temperatures likely to be encountered.

Wick Serves as a Filter

This matter of the wick serving as a filter is interesting in that it is more or less of an assurance that over the so-called life of the



Courtesy of Chassis Lubricating Co., Inc.

Fig. 14—Phantom view of a magazine oiler showing relative position of the wick and manner of constant delivery of oil by means of capillary action.

wick, clean oil will be delivered to the bearings, and water and dirt excluded. We must remember, however, that as the pores become more and more filled with foreign matter, a certain reduction in capillarity may occur. Wicks should, therefore, be cleaned about once

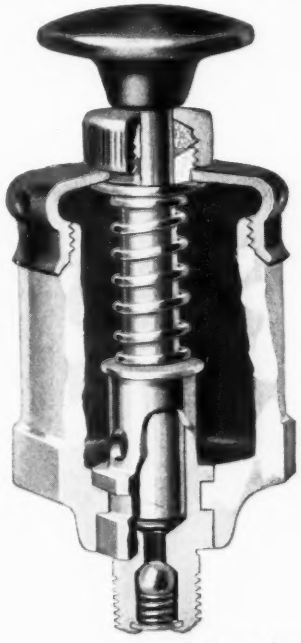
a year to keep them in condition for most effective operation and protection of all bearings involved.

Centralized Oiling Systems

A decidedly interesting departure from the accepted idea of unit lubrication of each part separately, has been the development of a system of automatic lubrication which functions by virtue of a central control, all chassis parts being flushed and supplied practically automatically with oil from a central reservoir.

How adaptable this may ultimately prove to the motor bus or truck is as yet hard to foretell. At any event, study of the principles involved will be of interest.

In such a system the reservoir is located beneath the floor boards, or in back of the dash; it is equipped with a suitable plunger or button which operates the pump. As a result lubrication of all parts connected thereto becomes but a matter of pressing the button or pulling the plunger several times whenever necessary or recommended by the builders. Once a day is the usual recommendation.

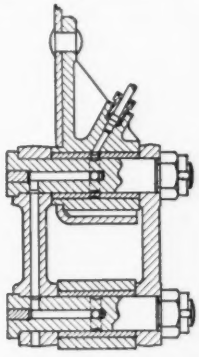


Courtesy of Madison-Kipp Corp.

Fig. 15—Cut-away view of a pressure oiling lubricator designed for individual application to chassis parts. Here is combined an oil reservoir with a spring operated plunger pump. To supply bearing with a "shot" of oil, the plunger handle is pulled out and released, forcing oil into the bearing under considerable pressure.

The fact that certain chassis parts will vary from others in regard to their oil requirements renders it necessary to provide for some arrangement of regulation or control of oil flow.

Practically this amounts to a metering of the oil in terms of drops. It can be brought about either by proper individual construction of the drip plugs, which in this case are also known as control outlets; by use of a control device located at the base of the pump; or by the installation of suitable adjusting manifolds at salient points in the system.



Courtesy of Bowen Products Corp.

Fig. 16—Sectional view of oil-lubricated spring shackle bolts showing piping from central reservoir, connection to bolt and oil-ways drilled for passage of oil from one bolt to the other.

Properly installed, such systems are exceedingly simple to operate and insure the delivery of clean oil to the respective bearings.

It is essential, however, that all parts be of rigid construction and capable of withstanding jars, shocks, and temperature fluctuations, for while all piping, etc. is concealed wherever possible within the chassis frame, it is relatively impossible to absolutely protect all parts from the chance of contact with stones, etc.

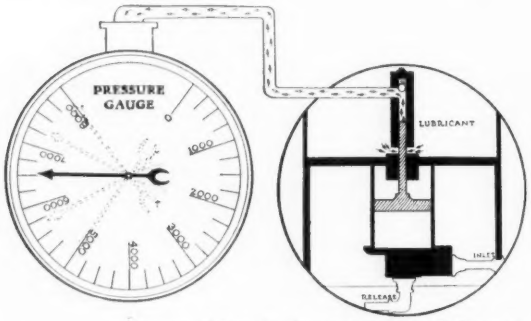
It is interesting to note that the possibility of entry of road dust into such a system is quite as negligible as in a pressure grease lubricator. To further insure that clean oil is used, however, certain central oil reservoirs are equipped with suitable filtering media such as a felt pad which is claimed to effectively remove any foreign matter that may have entered the oil in the course of storage or handling in the garage. Lubricating oils as received from, or delivered by reputable oil refiners, can be relied upon as being free from foreign matter.

GREASE HANDLING DEVICES

In the previous discussion on lubricating equipment mention has been briefly made to the power lubricator or compressor which is essential to grease lubrication by means of the pressure lubricating fitting. In view of the extent to which such equipment is used on the modern bus and truck today, detailed discussion will be of interest.

The principle involved is largely that of periodic renewal of the lubricant by means of adequate pressure commensurate with the consistency of the former. Re-charging of certain bearings with grease in this manner should be largely controlled or regulated by the outflow from the ends of the bearings.

In other words, grease is forced through the clearance spaces and bearing grooves (if any are provided) until a fresh film or emission appears at the furthermost exterior parts of the bearings. On the average chassis part, this is possible due to the fact that the steering gear bearings, spring shackle bolts, etc. are not of oil tight construction in the true sense of the word.



Courtesy of Gray Co., Inc., and The John P. Stetson Co.

Fig. 17—Sketch showing manner of attaching gauge and determining pressure developed by a grease compressor.

Such a condition facilitates the matter of grease lubrication by indicating when bearings have had enough, and also it enables the ready forcing out of deteriorated, contaminated or gummed grease, which otherwise would be a decided hindrance to effective lubrication. This is, in fact, one of the essential advantages of grease lubrication by means of pressure lubricators.

Equipment Involved

For this purpose lubricators of both the mechanical and air pressure type are used. For the handling of products, such as lighter greases, the hand or mechanical pressure gun, or the garage lubricator, which is operated by hand or foot pressure, is in general perfectly satisfactory.

Lubricant Adaptable

Considerable study and research has been given to this matter of pressure grease lubrication of late, and a product has been developed which, by virtue of its lubricating characteristics and the nature of its soap content, is markedly superior to certain types of cup grease.

It is possessed of certain very marked advantages, viz.: It is soft, pliable and plastic and yet with decided non-fluid tendencies. Furthermore, it is able to form and maintain its own housing and capable of "training," or adhering both to wearing surfaces as well as itself in much the same way that bread dough adheres and yet "strings out."

It is also resistant to heat and to centrifugal force, yet it has no tendency to separate or break up even under the hardest kind of rough treatment.

It is equally as capable of lubricating the ball bearings of a motor bus generator or motor as it is the roller bearings of front and rear wheels or the mechanisms of a universal joint.

It is capable of application by means of pressure lubricators or by hand; it does not drip or flow under high temperatures and it contains an oil of maximum lubricating quality, with the result that it is economical and capable of giving service for extensive periods of operation.

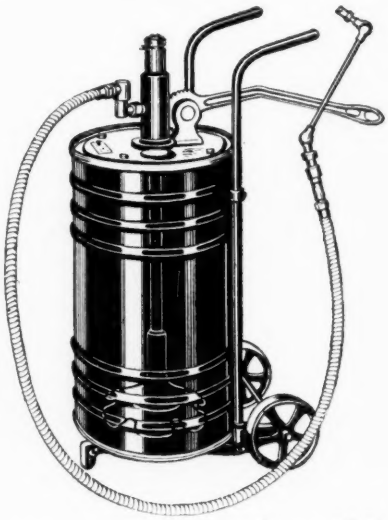
Such a product has proven to be eminently satisfactory and readily handled in pressure types of lubricators as shown in certain of the accompanying illustrations.

Mechanical Pressure Lubricators

Pressure lubricators have been noted as being of either the hand or power type. For the use of the individual bus owner or small fleet operator the former is perhaps the most suitable device, due to its ability to operate by means of hand or foot pressure.

Hand Pressure Guns

Grease guns of the hand pressure type will usually be capable of developing from 1,000 to 10,000 pounds pressure per square inch. They are practicable either with or without hose connections, according to the type of fitting they are designed for, or the location of the part to be lubricated.



Courtesy of Safety Lift Co.

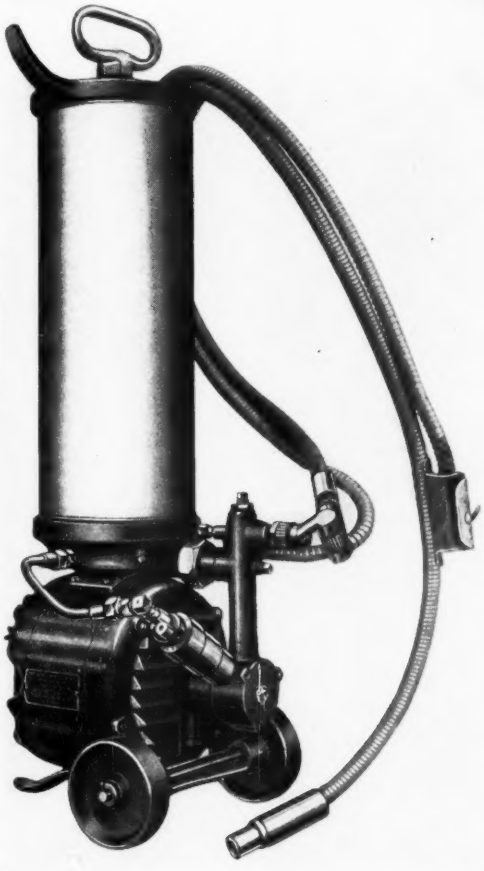
Fig. 18—Details of a drum type grease compressor or gun showing construction and arrangement of fittings.

Pressure can be applied either before or after attachment of the gun to the fitting. A frequent method of developing pressure is to force down a suitable plunger by means of a

threaded stem which screws into a bushing in the head of the gun. Another type of gun involves pumping action by means of the handle and a suitable pressure retaining device.

According to the design, where pressure is to be developed before attachment of the gun to the fitting, a suitable check valve must be installed in the tip. In certain guns the act of attachment opens this valve and automatically permits lubricant to be forced to the bearing.

The purpose of designing rigid connection guns with check valves is to eliminate the necessity for relieving the pressure before detaching the gun from the fitting and to enable pressure to be raised before attachment, to overcome the possibility of twisting off the fitting, which might otherwise occur. The direct



Courtesy of Carr Fastener Co.

Fig. 19—The "Dot" electric tank for handling of grease to chassis parts. This device is capable of developing 3,000 pounds pressure; it is one-man operated, easily portable and distinctive in its usage of electric power.

or swivel jointed connection also does away with the possibility of leaks in the flexible hose.

These factors are especially important where bearings are to be "started" involving the expulsion of grease which has been allowed to remain too long in the bearings and consequently become gummed, caked and mixed with dirt.

Courtesy of The Bassick Mfg. Co.

Fig. 20—Showing how the smaller hand grease gun can be used for individual lubrication of certain chassis parts in a practicable and positive manner.

Power Lubricators

In the garage or greasing station, however, the hand pressure gun is more or less supplanted by the portable mechanical or power lubricator of considerably greater grease capacity. In general such lubricators are capable of holding up to 100 pounds of grease.

The smaller guns are chiefly of the hand service type, that is, pressure is developed and grease discharged by the operation of a pump handle or lever.

A ball or check valve at the base of the pump automatically closes at the end of each stroke to retain all pressure that may have been built up in the gun and hose. To insure efficient operation this check valve must, of course, be kept clean. It should, therefore, be inspected at frequent intervals.

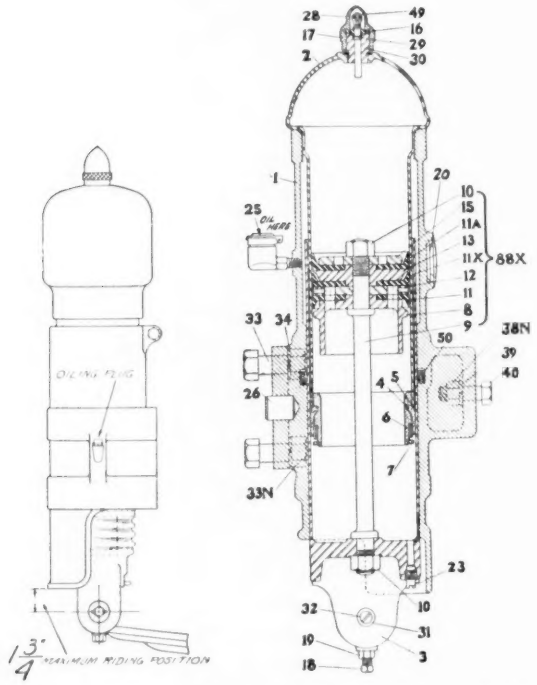
Pressures Involved

In such lubricators pressures of from 1,000 to 10,000 pounds are readily developed with but little exertion. These pressures are sufficient to effectively handle the usual grades of greases which are applicable to those strictly chassis parts, such as spring shackles and bolts, steering knuckles and rods, mechanical brake connections, etc.

The increasing preference for a specially compounded lubricant of more adhesive and lubricating ability as mentioned heretofore, on such parts as front and rear wheel bearings, universal joints, certain steering gear mechanisms and the clutch will usually require somewhat higher pressure for its effective delivery.

Electric and Pneumatic Compressors

Electric and pneumatic compressors have proved to be the most suitable for the handling of such heavier and more viscous greases. Such lubricators are usually of higher capacity than the hand service type, in certain cases



Courtesy of The Cleveland Pneumatic Tool Co.

Fig. 21—Two views of typical air springs for motor bus or truck service. To the left is shown the Westinghouse Spring which is of a rod type construction; to the right is the Gruss Air Spring involving a piston as shown. Note oiling location on each. On the Gruss spring 88-X indicates the piston assembly; 32 the shackle pin oil plug; and 50 a felt oil ring. A low pour test oil should be used on such equipment.

holding as much as 100 pounds of lubricants. In this latter capacity a multi-lead discharge manifold is frequently installed to enable the lubrication of a number of points simultaneously. Such compressors can be either electrically driven, or designed to take their air from an adjacent garage compressed air line. In other respects, however, the principles of the power lubricator or compressor are much the same as those involved in the hand service type.

An idea of the speed which may be attained with the full automatic electric compressor is gained from the report of a large fleet owner, who recorded the complete lubrication of ten trucks in thirty minutes. This type of equipment may be either stationary or portable, as customers require.

ESSENTIALS TO EFFECTIVE LUBRICATION

It is obvious that most effective results can only be obtained from any lubricant or form of chassis lubricator provided that every care is observed in the handling of the former, and periodic inspection and refilling carried out in respect to the latter.

The vital considerations in this regard will be:

1. A well constructed pit, or an elevated run-way to facilitate working around the chassis, and inspection of the condition of all parts requiring lubrication, and the lubricating equipment involved.
2. An orderly arranged garage with an oil room apart from the car storage space, to insure against contamination of lubricants as far as possible.
3. Oil and grease storage equipment of ample capacity to carry an adequate reserve supply of lubricants commensurate with the location of the garage and the delivery facilities.
4. Lubricating equipment of proven design and efficiency which will not require attention on the road and which will afford the maximum of positive action at all times, and
5. A system of records, inventory and accounting in the garage which will absolutely assure that all chassis parts will be relubricated or lubricators have their charge of lubricant renewed before there is any possibility of faulty lubrication or undue wear occurring.

Means to Facilitate Lubrication

The pit or elevated run-way is one of the most important adjuncts to effective chassis lubrication. We can realize that regardless of the suitability of any lubricant or the efficiency of the lubricating equipment, the means of application of the former must be such as to absolutely assure the most complete access to every part involved.

If, therefore, a mechanic is compelled to lie on his back beneath the bus, to feel around for a lubricating fitting due to imperfect lighting, and perhaps with the possibility of caked dirt or grease dropping into his eyes, it is perfectly evident that he cannot perform his duties most efficiently. The result will be that certain parts may be over-lubricated, others but partly covered, and even some carelessly or unintentionally overlooked entirely.

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